Oct. 4, 1960 A. ROTH 2,955,053

PROCESS FOR SELECTIVELY COLORING GLASS FABRIC AND RESULTANT ARTICLE

Filed Aug. 20, 1958 2 Sheets-Sheet 1

Fig. 1.

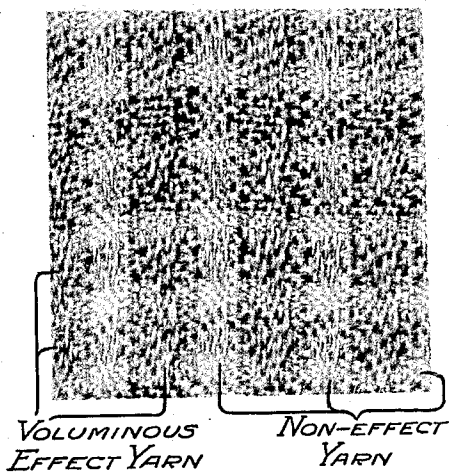


Fig. 2.

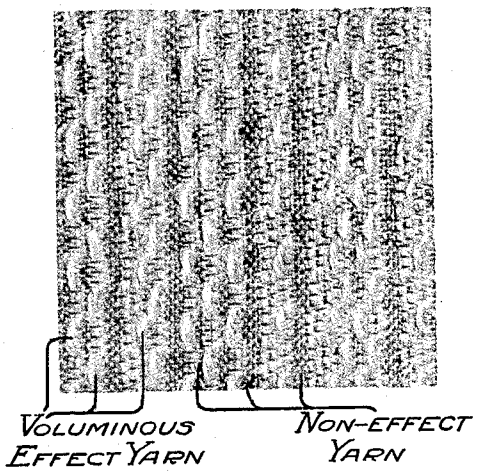


Fig. 3.

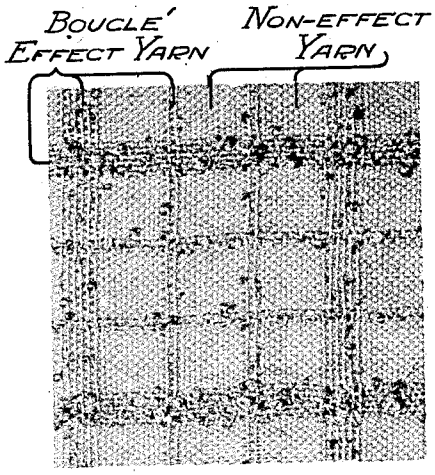
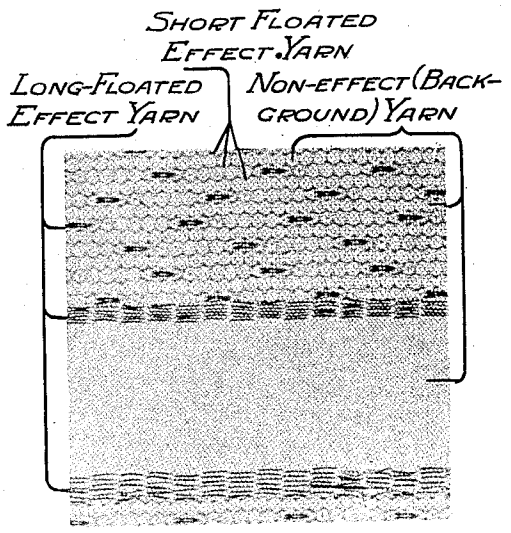


Fig. 4.



IDENTICAL WARP AND FILL YARNS

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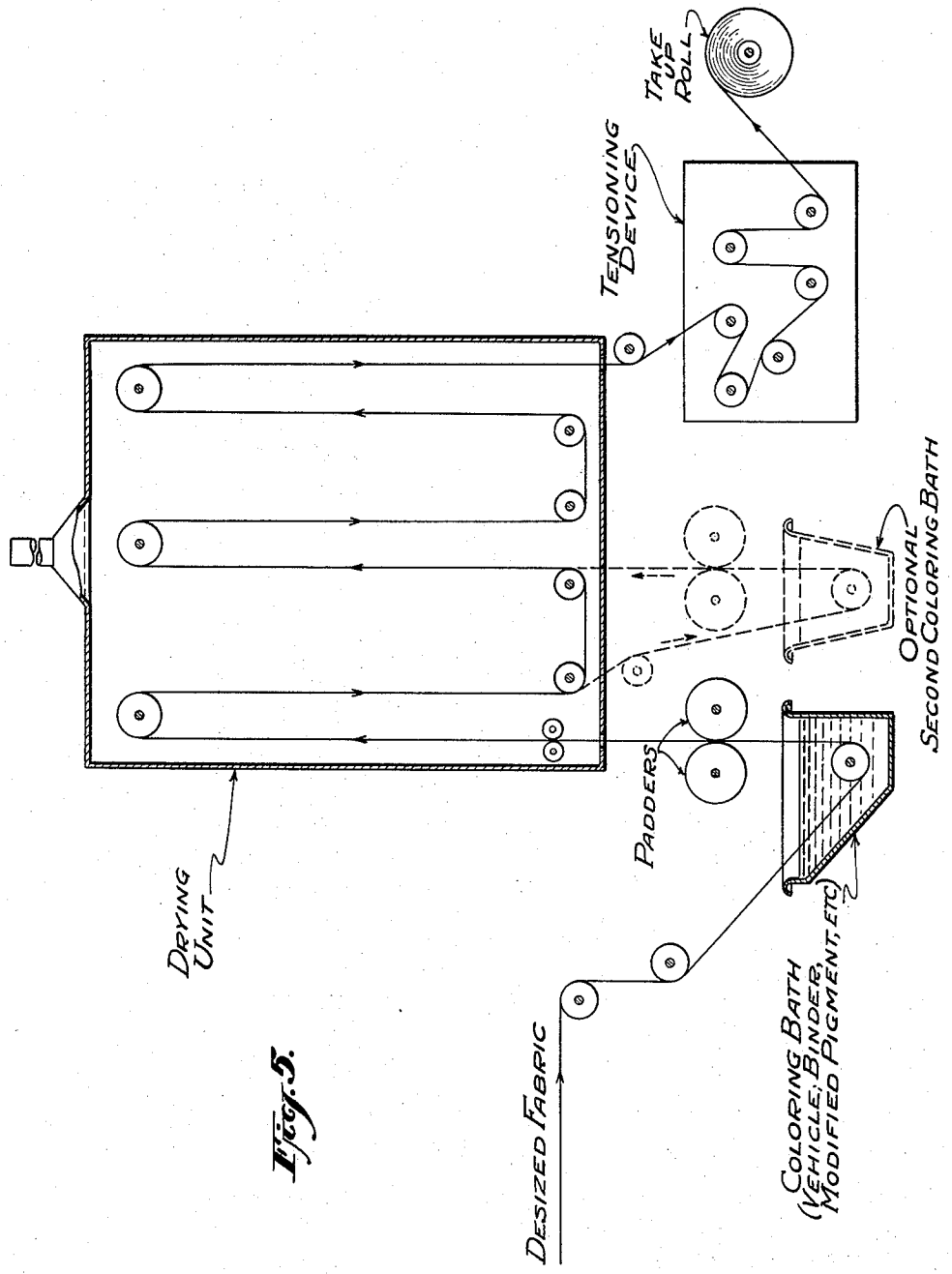


Fig. 5.

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2,955,053

PROCESS FOR SELECTIVELY COLORING GLASS FABRIC AND RESULTANT ARTICLE

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15 Claims. (Cl. 117—37)

This invention relates to a textured textile fabric product, containing effect and non-effect yarns of the same material, which has been selectively colored by over-all pigment padding. As a result of such padding the effect or non-effect yarns, as desired, selectively carry substantially all of a pigment precipitated from the padding bath to the substantial exclusion of said pigment on the other yarn.

The present invention also relates to processes for producing the selectively colored fabric products and particularly to processes for so coloring textured glass fabrics. In a further aspect it relates to modification of conventional pigment padding baths to enable the same to selectively color the desired yarn in the fabric.

The term "textured fabric" as employed herein is intended to include such fabrics woven so as to present an uneven or non-uniform surface. Such fabrics are generally produced by employing textured or novelty yarns referred to herein as "effect" yarns, along with normal or "non-effect" yarns. The effect yarn may for example be a ratine, slub or other yarn produced by continuous or periodic overfeeding during formation. It is often a voluminous yarn, as distinguished from a conventional continuous filament or bundle of continuous filaments which generally make up the non-effect yarns. The novelty or effect yarn is of course woven along with the non-effect yarn in a pattern so as to produce various pleasing effects in the finished fabric.

Textured fabrics may also be produced, without resort to the novelty yarns above described, simply by irregularly weaving the same or substantially the same warp and filler yarns. For example, at spaced intervals either the warp or filler yarns of a casement fabric may be floated above the weave. Such a material is termed a float fabric. For purposes of the present invention the yarns where floated are effect yarns and the yarns where woven normally are non-effect yarns.

It is well known that fabrics fashioned of glass cannot be dyed as cotton or rayon for example. By reason of the chemical inertness of the base material dyeing techniques are ineffective on such materials. Accordingly, a binder must be employed to cause a physical adherence between a coloring agent and the glass. The binder is generally a resinous material such as polyacrylic latex, certain of the silicones, or polyvinyl alcohol or polyvinyl acetate. It is preferably applied to the fabric along with the color bearing material which is an organic or inorganic pigment, for example, vat pigments, metallic oxides, carbon black, etc. All coloring baths thus always contain the pigment and a binder.

The pigment is dispersed in a liquid medium or vehicle, generally water, containing the binder and also preferably a softening agent which improves the water repellency of the colored fabric, lubricates the glass fibers and generally improves the hand of the fabric. Suitable softening agents include du Pont's "Teflon 30," cationic softeners, as well as certain silicone oils. The dispersion

may also contain a dulling and anti-slipping agent, for example, colloidal silica (Monsanto's "Syton" or du Pont's "Ludox") or titanium dioxide pigment. Where the binder is a normally water soluble material such as polyvinyl alcohol, provision must also be made for insolubilizing this material either following or as an adjunct of the coloring operation. Du Pont's "Quilon," a stearato chromic chloride is preferred for this purpose. It protects the finish against water and gives wash fastness.

In conventional coloring of glass fabric a single color only can be imparted to the fabric. The thermally desized cloth is drawn in continuous length through a bath containing pigment, binder and generally one or more of the materials aforesaid, passed between squeeze rollers which remove excess liquid, and then dried. The coloring process is thus a pigment padding operation, and the pigment is deposited uniformly on the fabric, whether textured or not.

In order to obtain the illusion of different colors in glass fabric so treated, manufacturers and finishers have resorted to the use of dramatic effect yarns to produce textured fabrics. The effect yarns reflect light differently from the background or non-effect yarns thus giving the illusion of different shades of the color padded onto the goods. As an illustration, a very loosely formed voluminous yarn when colored blue for example will present to the eye a substantially different shade of blue than a continuous, lighter, non-voluminous yarn of the same material colored exactly the same blue. In accordance with the present invention it is now possible to selectively color the effect or the non-effect yarns by the usual pigment padding technique wherein the entire fabric is immersed in the coloring bath, and so produce a textured fabric in which some of the yarns only are colored, for example. By a subsequent treatment the yarns initially uncolored may be selectively colored.

It has not yet been possible to pretreat the glass yarns, for example the effect yarns, with a chemical agent prior to weaving of the fabric which will enable selective pick-up of pigment during the padding operation, or in essence to employ the techniques of cross-dyeing to the pigment padding of glass fabrics. This technique has not been successfully developed by reason of the fact that the fabric before coloring must be completely desized in order that the binder may adhere properly to the glass. The size and oils applied to the yarn prior to weaving of the fabric are removed by thermally treating the glass at temperatures up to about 1400° F., or at least sufficiently high that the size ignites and burns with an open flame on the surface of the cloth. Thus, agents which might be applied to selected yarns prior to weaving would be rendered ineffective by the temperature of the flame during desizing.

However, one method has been developed which will enable the production of a multi-colored glass fabric. It consists in applying heat insensitive pigment to selected yarns, for example the effect yarns, prior to weaving the fabric. The pigments employed must be insensitive to the flame temperature reached during desizing, and for this reason such pigments are costly and few colors are available at the present time. Following desizing of the fabric containing the preliminarily colored effect yarns, the background or non-effect yarns may be colored by a conventional pigment padding operation as above described. During such coloring, pigment from the bath is deposited uniformly in the uncolored and previously colored areas, and the color initially applied to the effect yarns is thus changed to some extent. This of course limits the choice of background colors in order that the preliminarily colored areas shall be pleasing to the eye.

Such preliminary coloring of the effect and or non-effect yarns is quite costly as compared with simple pigment padding of a woven fabric.

The product of the present invention is an over-all pigment padded, textured fabric, the effect yarns or the non-effect yarns of which selectively carry precipitated pigment from the padding bath to the substantial exclusion of the pigment on the other yarns. The yarns are not preliminarily treated to facilitate pigment selection from the padding bath. In the colored fabric product, the effect yarns have a much higher weight ratio of a given pigment to yarn than do the non-effect yarns, or vice versa. Also the effect yarns may have a much higher ratio of one pigment to yarn, and the non-effect yarns a higher ratio of another pigment to yarn.

The product is colored by padding with a pigment color bath which has been modified to cause selection to the effect or non-effect yarns of the fabric as the case may be. It is to be understood that the selective coloring referred to herein is not complete selectivity since in passing the fabric through a padding bath a slight amount of the pigment will become entrapped in or on the yarns not being selectively colored. However, and as a practical matter, selection may be said to be substantially complete with substantially all of the pigment selectively deposited on the desired yarns.

In the accompanying drawings:

Fig. 1 is an enlarged photograph of the fabric colored by the method of Example VII;

Fig. 2 is a similar photograph of the fabric colored by the method of Example IX;

Fig. 3 is a similar photograph of a glass fabric containing boucle effect yarns which have been selectively colored brown and continuous non-effect or background yarns which have been selectively colored light blue in accordance with the methods of the present invention;

Fig. 4 is a similar photograph of a glass casement fabric in which certain of the yarns are floated above the surface and these floated or effect yarns have been colored green in accordance with the method of the present invention; and

Fig. 5 is a schematic flow sheet, containing descriptive legends, of one embodiment of the process of the present invention.

According to the present process, when it is desired to selectively color the effect yarns of the fabric, a conventional pigment padding bath which would normally impart overall color to the fabric is caused to selectively color the effect yarns or the non-effect yarns as desired, to the substantial exclusion of the other yarns, by altering the electrical charge upon the pigment particles or aggregates of particles.

I have not positively established the exact mechanism by which selection occurs but the following is offered as a plausible explanation.

The mechanism proposed is that selective coloring of a specific area of a glass fabric is achieved by imposing a charge on the pigment particle or aggregate such that it will move to the area of the fabric of the highest charge but of opposite sign or to the areas of lowest potential of the same sign. Although all the glass fabric surface is anionic, textured yarns, ratine yarns and long float areas in plain continuous filament fabrics have a higher potential that the body of the fabric. It is because of this difference in potential on the various areas on the fabric that selective coloring can be achieved in accordance with the present invention by varying the charge on the pigment aggregate as mentioned above. Proof of this mechanism can be stated as follows:

According to Glasstone's Textbook of Physical Chemistry (second ed.) pp. 1240–41: ". . . if a dilute solution of a silver salt is added to excess of dilute potassium iodide a negatively charged sol ([Ag I] I—) of silver iodide is obtained, while if the dilute iodide solution is

added to excess of the silver solution a positively charged sol ([Ag I]Ag+) results."

If such a positively charged sol is padded on to a glass fabric, as for example a fabric containing 25% textured or effect yarn, selection to the effect yarn occurs. After such padding and drying, the color was developed by placing the fabric for one minute in a muffle furnace at 1200° F. A pale yellow developed substantially completely on the textured yarn.

According to Morey: "Properties of Glass," American Chemical Society, Monograph Series #77, page 435: "Silver, which has weak tinctorial power, gaves glass a yellow color, ..."

If the negatively charged colloid prepared in the manner described above is padded on to the same type glass fabric and the same procedure is followed, a more or less level coloring of the fabric is achieved. Selection to the background in preference to the textured area of the fabric can be achieved by using chromatographic technique.

The above not only illustrates that there is a difference in potential between the various areas of the glass fabric but that appropriately charged particles or aggregates of color under favorable conditions will move selectively to the area to which they are most strongly attracted or least strongly repelled as the case may be.

The pigment particles in a conventional padding bath are negatively charged. Now in order to cause selection of pigment to the effect yarns, I effectively lower the negative charge on the aggregates or cause them to become positively charged. As a result of this effective change of charge, during immersion of the glass fabric in the bath the pigment particles are attracted to the more highly anionic effect yarn. This effective charge change may be brought about by acidifying the bath or adding a small quantity of a di- or trivalent metal ion such as magnesium and aluminum to a pigment dispersion which contains colloidal silica. These additions need only be of the order of about 0.1–0.5% by weight of the bath which generally contains about 0.5 to 3% pigment. Colloidal silica becomes unstable as its pH is passed from above about 8 to below about 6. When the pH is so lowered some agglomeration occurs and also the effective charge on the silica is changed. With pigment and binder present, it is believed these materials coalesce with the silica and it is on the resulting particle that a charge is established which directs it to the effect yarn. As noted above, the charge change may be brought about by lowering the pH of the bath, specifically into or below the range in which the colloidal silica is unstable, that is below about 8.

Baths not containing colloidal silica can be caused to deposit pigment on the effect yarns substantially completely by introducing trivalent ions, for example aluminum. It is believed that an agglomeration of the pigment particles occurs and a positive charge is established on the larger particle by reason of the presence of the trivalent ions.

When it is desired to cause selective precipitation of the pigment from the padding bath onto the non-effect yarns, which generally constitute the background of the fabric and are only slightly negative or neutral, the anionic charge on the pigment particles or aggregates is increased. This may be accomplished by adding hydroxyl ions to the bath, preferably as ammonium hydroxide. For example, a conventional bath is modified by the addition of sufficient ammonia to raise its pH to about 10 or above. During padding the so modified particles are repelled by the highly negative effect yarns and are deposited upon the relatively less negative or neutral non-effect yarns. It is entirely possible that selectivity in the background areas of the fabric is determined by the hydroxyl ion concentration alone and accordingly the pH of the treating bath.

In the following examples, Numbers I and II illustrate

the technique of conventional pigment padding as now practiced to attain level coloring of a textured glass fabric, as compared with the process of the present invention for obtaining selection to the effect or the non-effect yarns of similar fabrics as shown in the remaining examples. In each of the examples the percentage values refer to the total bath through which the fabric is passed. The dispersions were brought to 100% with water. All ingredients were added in the order listed and in dilute form except the "Ludox HS," which was added as a 30% sol.

Example I

An aqueous level coloring bath was prepared which contained:

1% SXN Brown R (Interchemical Corporation)
4% "Hycar PA4501" (B. F. Goodrich brand of polyacrylic latex)
4% "DC–36" (Dow-Corning brand of dimethyl polysiloxane oil)
4% "Syton DS" (Monsanto brand of colloidal silica)

A thermally desized glass fabric constituted as follows:

Count—56 x 34
Warp: 2528 ends of 150's 1/0
Filling:
17 px of ECDE 150's 1/0
17 px of ECDE 150's 1/4 Textured yarn 50/50 blend

was quickly passed through the above bath, thence immediately through squeeze rollers to remove excess liquid and then dried. The dried fabric was colored substantially uniformly throughout, but by reason of its textured surface gave the impression in the areas of the effect yarn of being a slightly different shade of peach than the non-textured yarns.

Example II

A thermally desized glass fabric constituted as follows:

Count—40 x 32
Warp:
1 beam 924 ends of ECDE 150's 1/4 Textured yarn
1 beam 944 ends of ECDE 150's 1/0 50/50 blend
Filling:
1 fill—16 px of ECDE 150's 1/0
1 fill—16 px of ECDE 150's 1/4 Textured yarn 50/50 blend

was passed through the bath of Example I, thence between squeeze rollers and dried in the usual manner. The thus treated material was substantially uniformly colored throughout with the textured portion giving the impression of a slightly lighter shade than the non-textured areas of the fabric.

Example III

An aqueous pigment padding bath was prepared by adding to water the following materials in the sequence set forth:

1% SXN Brown R
2% "Hycar PA4501"
0.2% Magnesium sulfate
3% "Ludox HS"
3% "Hycar 4501"
3% "SM–62" (General Electric brand of dimethyl polysiloxane oil)

The pH was 8. It was adjusted to 4 with the addition of a 10% acetic acid solution after which 3% "Quilon S" was added to assure wash fastness. The pH adjustment prior to "Quilon" addition was necessary in order to prevent decomposition of this material. A piece of the desized fabric of Example I was quickly passed through the above bath, squeezed and dried. Pigment was selectively deposited upon the textured yarns of the fabric to the substantial exclusion of pigment on the non-textured yarns, which retained their original white appearance.

Example IV

A sample of the desized fabric of Example II was quickly passed through the coloring bath of Example III, padded and dried. The pigment from the bath was selectively deposited upon the effect yarns of the fabric. Upon critical examination the non-effect yarns exhibited only a very slight trace of pigment. To the untrained eye they appeared not to have been colored at all. Examples III and IV thus illustrate one method of selectively coloring only the effect yarns of the fabric.

Example V

A padding bath was prepared as set forth in Example III with the exception that the pH was not adjusted nor was "Quilon S" added. The pigment from this bath was selectively deposited on the textured yarns of the fabric of Examples I and II.

Example VI

A padding bath was prepared as set forth in Example III with the exception that magnesium sulfate was omitted. pH was adjusted as set forth in Example III. Immersion of the desized fabrics of Examples I and II therein followed by padding and drying resulted in a selective deposition of pigment on the textured yarns. The pH adjustment was through the unstable range of the colloidal silica which resulted in a charge change on the silica and pigment particles and caused selection.

Example VII

A padding bath was prepared by adding the following materials to water in the order set forth:

1% SXN Brown R
0.2% Basic aluminum acetate (added as a 5% solution)
3% "Hycar PA 4501"
3% "SM 62"

A sample of the thermally desized fabric of Example II was pigment padded in the aforementioned manner with the above bath. The resulting fabric, as shown in Fig. 1, was slightly more contrasty than that of Example III due to heavier deposition of pigment. Substantially all of the pigment was selectively deposited on the effect yarns.

Example VIII

A thermally desized sample of the fabric of Example II was pigment padded with the bath of Example VII, and the resulting fabric was slightly more contrasty than the fabric of Example IV, the pigment being selectively deposited upon the effect yarns of the fabric with the non-effect yarns remaining white.

Examples VII and VIII illustrate another method for modifying a conventional pigment padding bath, to cause selective pigment deposition on the effect yarn. Without the addition of the basic aluminum acetate, the bath of Example VII uniformly colored samples of the fabric of Examples I and II.

Example IX

A padding bath was prepared by adding the following materials in the sequence set forth to water:

1% SXN Brown R
4% "Hycar 4501"
4% "DC–36"
3% "Ludox HS"

Following dispersion the bath had a pH of 8.4. This pH was adjusted upward to 10 with concentrated ammonium hydroxide. A thermally desized fabric as follows:

Count—56 x 40
Warp: 2528 ends of ECDE 150's 1/0
Filling:
30 px of ECDE 150's 1/0
10 px of ECDE 150's 1/4 Textured
25% Textured/75% Casement

was passed through the bath, through a pair of padding rollers and dried by passing the underside of said fabric in contact with a drum heated to the temperature of 400° F. The resulting fabric, as shown in Fig. 2, was selectively colored in the non-effect or background areas. The textured yarn picked up only a trace of the pigment imparted to the fabric and retained its natural whiteness, to produce an exceedingly striking and contrasty fabric.

Example X

A thermally desized glass fabric as follows:

Count—56 x 36
Warp: 2528 ends of ECDE 150's 1/0
Filling:
18 px of ECDE 150's 1/0
18 px of ECDE 150's /4 Textured
50/50 blend

quite similar to that of Example IX was pigment padded with the bath of Example IX, but dried in air. Due to the wick action which occurs during normal air drying, the raised, textured effect yarns of the fabric picked up substantially more color than did the effect yarns in Example IX, wherein the fabric was contact dried. Accordingly, it is recommended that in the selective pigment padding of the non-textured portions of a fabric that the fabric be dried on a hot drum, with the wrong or underside of the fabric in contact with the drum. Quick contact drying reduces wick action and any wick action that does occur will tend to withdraw mobile pigment from the raised effect yarns.

Example XI

A glass fabric having a count of 56 x 54 single 150's with the filling yarns periodically floated at regular intervals over from 3 to about 9 warp yarns was pigment padded in the usual manner with an aqueous bath containing the following materials, added to water in a sequence set forth:

1% Lumatex pink 3B (Putnam Chemical Co.)
3% "Hycar PA 4501"
0.2% Basic aluminum acetate (added from a 10% solution)
4% "Ludox HS"
4% "SM–62"

Following padding the floated or effect yarns were colored a pale pink, while the background or non-effect (non-floated) yarns remained substantially their original uncolored white. The addition of aluminum salt to the above bath was calculated to cause selection to the raised floated yarns.

It is also within the scope of the present invention to prepare a single bath containing two different pigments, blue and yellow, for example, and by a single padding operation selectively pigment the effect yarns blue and the non-effect yarns yellow. In order to do this the appropriate charge must first be established on the pigment of separate padding baths, and the pH so adjusted that when the baths are mixed the charges so established are not disturbed. The final pH of the mixed bath is always above 7.

It is also within the scope of the present invention to selectively color the effect or non-effect yarn by pigment padding, followed by a non-selective pigment padding by virtue of which a second pigment is deposited uniformly on the fabric.

The present process thus enables selection of pigment to the effect or non-effect yarns of the fabric from a pigment padding bath. While substantially all of the pigment imparted to the fabric may thus be caused to be deposited on the effect yarns, for example, these yarns are not in fact uniformly or regularly colored. Where the effect yarn is on the upper or lower surface of the fabric deposition is heavy and substantially uniform but where these yarns are covered by non-effect yarns or other effect yarns, depending upon the weave, deposition is comparatively light. Thus a given effect yarn may be heavily colored on one side and only slightly colored on the other.

The fabric product thus contains irregularly but selectively colored effect or non-effect yarns. These yarns appear regularly colored on the surface of the fabric.

I claim:

1. A process for selectively coloring the effect yarns of a glass fabric having effect and non-effect glass yarns, which comprises immersing the fabric in a coloring bath comprising a liquid vehicle, a binder material and a normally anionic pigment, said bath being so modified as to create an effective positive charge on particles and aggregates of pigment, withdrawing the fabric, padding and drying the same.

2. A glass fabric having effect yarns which have been colored by the method of claim 1.

3. A process for selectively coloring the effect yarns of a glass fabric having effect and non-effect glass yarns, which comprises immersing the fabric in a coloring bath comprising a liquid vehicle, a binder material and a normally anionic pigment, so modifying said bath as to create an effective positive charge on particles and aggregates of pigment, withdrawing the fabric, padding and drying the same.

4. A process for selectively coloring the effect yarns of a glass fabric having effect and non-effect glass yarns, which comprises providing a coloring bath comprising a liquid vehicle, a binder material and a normally anionic pigment, so modifying the bath as to create an effective positive charge on particles and aggregates of pigment, immersing the fabric in the modified coloring bath, withdrawing the fabric, padding and drying the same.

5. A process for selectively coloring the effect yarns of a glass fabric having effect and non-effect glass yarns, which comprises providing an aqueous coloring bath comprising a binder material and a normally anionic pigment, introducing cations to said bath in amount sufficient to create an effective positive charge on particles and aggregates of pigment, immersing the fabric in the resulting coloring bath, withdrawing the fabric, padding and drying the same.

6. A process as set forth in claim 5 wherein the cations are trivalent metal ions.

7. A process as set forth in claim 5 wherein the cations are aluminum ions.

8. A process for selectively coloring the effect yarns of a glass fabric having effect and non-effect glass yarns, which comprises providing a coloring bath comprising water, a binder material, colloidal silica and a normally anionic pigment, introducing cations to said bath in amount sufficient to create an effective positive charge on particles and aggregates of pigment, immersing the fabric in the resulting coloring bath, withdrawing the fabric, padding and drying the same.

9. A process as set forth in claim 8 wherein the cations are divalent metal ions.

10. A process as set forth in claim 9 wherein the divalent metal ions are magnesium ions.

11. A process as set forth in claim 8 wherein the cations are hydrogen ions, and they are slowly introduced by acidifying the bath to a pH below about 8.

12. A process for selectively coloring the non-effect yarns of a glass fabric having effect and non-effect glass yarns, which comprises immersing the fabric in a coloring bath comprising a liquid vehicle, a binder material and a normally anionic pigment, said bath being so modified as to increase its effective hydroxyl ion concentration to a pH of at least about 10, thereby increasing the anionic charge on the pigment, withdrawing the fabric, padding and drying the same.

13. A glass fabric having non-effect yarns which have been colored by the method of claim 12.

14. A process for selectively coloring the non-effect yarns of a glass fabric having effect and non-effect glass yarns, which comprises providing an aqueous coloring bath comprising a binder material and a normally anionic pigment, so modifying said bath as to increase its effective hydroxyl ion concentration to a pH of at least about 10, thereby increasing the anionic charge on the pigment, immersing the fabric in the modified coloring bath, withdrawing the fabric, padding and drying the same.

15. A process for selectively coloring the non-effect yarns of a glass fabric having effect and non-effect glass yarns, which comprises providing an aqueous coloring bath comprising a binder material and a normally anionic pigment, introducing hydroxyl ions to the bath to increase its pH to at least about 10, thereby increasing the anionic charge on the pigment, immersing the fabric in the modified coloring bath, withdrawing the fabric, padding and drying the same.

References Cited in the file of this patent

UNITED STATES PATENTS

2,105,509	Schwartz	Jan. 18, 1938
2,173,243	Young	Sept. 19, 1939
2,317,965	Bestian	Apr. 27, 1943
2,507,561	Dreyfus et al.	May 16, 1950
2,543,718	Cassel	Feb. 27, 1951
2,726,133	Helfenberger	Dec. 6, 1955

FOREIGN PATENTS

300,951	Great Britain	1930